Geometric and counter-diabatic optimization of quantum annealing protocols

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In this talk I will discuss two complimentary approaches for optimization of quantum annealing protocols (i) based on minimizing the quantum length as defined through the geometric tensor and (ii) on adding counter-diabatic terms to the driving Hamiltonians. In particular, I will discuss how non-adiabatic corrections leading to transitions appear in the moving frame and how one can minimize them. I will present a new variational approach for finding counter-adiabatic terms and will show that in some generic problems it can increase final fidelity of the annealing protocol by many orders of magnitude. I will also mention possible extensions of these approach to imaginary time, amenable to quantum Monte-Carlo simulations.